

WHAT IS CLAIMED IS:

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1. A piezoelectric element comprising:  
a piezoelectric substrate, and  
5 a pair of electrodes formed on at least one principal plane selected from the group consisting of a first principal plane of the piezoelectric substrate and a second principal plane opposed to the first principal plane, wherein thickness shear vibration occurs, and  
a vibration direction of the thickness shear vibration is nonparallel to  
10 a side wall of the piezoelectric substrate.
2. The piezoelectric element according to claim 1,  
wherein the piezoelectric substrate has a shape of an elongated rectangular solid, and  
15 each of the pair of electrodes is formed along an entire width in a traverse direction of the substrate on said at least one principal plane.
3. The piezoelectric element according to claim 2,  
wherein the piezoelectric substrate is formed of  $\text{LiTaO}_3$  single crystal,  
20 the pair of electrodes includes a first exciting electrode and a second exciting electrode,  
the first exciting electrode is formed on the first principal plane,  
the second exciting electrode is formed on the second principal plane,  
the side wall is a side wall in a longitudinal direction of the  
25 piezoelectric substrate, and  
a normal line of an edge of the first exciting electrode and a normal line of an edge of the second exciting electrode are parallel to each other and are nonparallel to the side wall in the longitudinal direction.
- 30 4. The piezoelectric element according to claim 3,  
wherein the first and second principal planes are X planes of the piezoelectric substrate, and  
the side wall in the longitudinal direction is parallel to a plane  
obtained by rotating an XY plane of the piezoelectric substrate for  $56^\circ$  to  $58^\circ$   
35 clockwise about an X-axis.
5. The piezoelectric element according to claim 4,

wherein the direction of the normal line is a direction obtained by rotating Y-axis of the piezoelectric substrate for 47° to 56° clockwise on a YZ plane.

- 5     6. The piezoelectric element according to claim 5,  
         wherein the width W and the thickness H of the piezoelectric  
         substrate satisfy the relationship  $2.9 \leq W/H \leq 3.1$  or  $3.7 \leq W/H \leq 3.9$ .

- 10    7. The piezoelectric element according to claim 6,  
         wherein the piezoelectric substrate includes first and second  
         piezoelectric substrates, and  
         the first piezoelectric substrate and the second piezoelectric  
         substrate are stacked in such a manner that their polarization directions are  
         opposite to each other.

- 15    8. The piezoelectric element according to claim 6,  
         wherein the side wall in the longitudinal direction is a plane cleaved  
         by laser irradiation.

- 20    9. The piezoelectric element according to claim 2,  
         wherein the piezoelectric substrate is formed of  $\text{LiTaO}_3$  single crystal,  
         the pair of electrodes includes an input electrode and an output  
         electrode,

25           the input electrode and the output electrode are formed on the first  
         principal plane of the piezoelectric substrate,

         the piezoelectric element further comprises a ground electrode  
         formed on the second principal plane,

         the side wall is a side wall in a longitudinal direction of the  
         piezoelectric substrate, and

- 30           a normal line of an edge of the input electrode and a normal line of an  
         edge of the output electrode are parallel to each other and are nonparallel to  
         the side wall in the longitudinal direction.

- 35    10. The piezoelectric element according to claim 9,  
         wherein the first and second principal planes are X planes of the  
         piezoelectric substrate, and  
         the side wall of the piezoelectric substrate is parallel to a plane

obtained by rotating an XY plane of the piezoelectric substrate for 56° to 58° clockwise about an X-axis.

11. The piezoelectric element according to claim 10,

5        wherein the direction of the normal line is a direction obtained by rotating a Y-axis of the piezoelectric substrate for 47° to 56° clockwise on a YZ plane.

12. The piezoelectric element according to claim 11,

10        wherein the width W and the thickness H of the piezoelectric substrate satisfy the relationship  $2.9 \leq W/H \leq 3.1$  or  $3.7 \leq W/H \leq 3.9$ .

13. The piezoelectric element according to claim 12,

15        wherein the piezoelectric substrate includes a first piezoelectric substrate and a second piezoelectric substrate, and  
         the first piezoelectric substrate and the second piezoelectric substrate are stacked in such a manner that their polarization directions are opposite to each other.

20        14. The piezoelectric element according to claim 12,

         wherein the side wall in the longitudinal direction is a plane cleaved by laser irradiation.

15. A mobile communication device comprising the piezoelectric element  
25        according to claim 1.